



# Conservation Curriculum

## Energizing Minds

Linking energy and conservation is what it is all about. The curriculum insert for this issue of *The Resource* provides three levels of activities:

**Early childhood** - "Energy puzzles" help children match energy users with the forms of energy used. This is just one of several early childhood lessons in energy taken from the recently revised publication *Conservation Seeds*. Refer to page C-8 for complete information on this publication that helps young children become aware of nature and conservation.

**Grades 5-8** - "Name that Energy Source" teaches students about renewable and non-renewable energy sources. What are our options for the future?

**Grades 9-12** - "What a Bike!" incorporates math skills in calculating the static efficiency of a bicycle. What a great opportunity to discuss alternative transportation!

## From the Department of Natural Resources

The Department of Natural Resources offers a graduate credit course titled ENERGY FOR MISSOURI: TODAY AND TOMORROW. This two-day session is designed to provide teachers with a basic understanding of energy use and present methods for teaching these issues in the classroom. Participants receive educational activities promoting energy awareness and energy conservation practices. For more information concerning this course or additional environmental education classes offered by the Department of Natural Resources contact the Environmental Education Unit at 1-800-361-4827.



## ENLIST

### Grades 5-12 teachers needed

The Missouri Department of Conservation wants to recruit you. We are currently working on new materials for our junior high and high school audiences. There are two types of involvement:

First, you can fill out a short survey to help us determine the best possible products for you. What criteria must a lesson plan or activity fulfill? What types of media work best for you? If you are willing to fill out one of the surveys, please contact us and we will mail it to you.

Second, you may wish to participate in product development. This is done in a couple of ways:

- Occasionally we contract with an individual to write a short activity, review a manuscript, develop correlations, etc.
- Often we contract with a teacher to serve as part of a development team for a specific product. Products that may require development teams this year include WebQuests and Thematic Units. If you are interested in being a candidate for participation in upcoming projects please mail a cover letter and short resume. We ask that you provide specific information about your interests in conservation so that we can best match you to a topic and/or product.

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# Energy Puzzles



PreK-2

This early childhood lesson comes from the recently revised edition of *Conservation Seeds*. Please refer to page C-8 for complete information on this publication.

## Objectives:

This activity will help young children match energy users with the energy. This manipulative lesson will test their fine-motor skills, eye-hand coordination as well as provide a basis for questioning and explanation.

## Materials:

- Clear contact paper
- Copy of energy puzzles (copy page) mounted on cardboard

## Procedure:

1. Color and cover the energy puzzles with contact paper and cut them apart.
2. Place the energy puzzles in the manipulative area during self-selected activity time.
3. Encourage children to match the energy-users to the types of energy used. Discuss their choices and how the puzzles fit together.

## Questions you might ask:

- .What kinds of energy do you use at your house?
- .What would happen if we ran out of any of these kinds of energy?

## Supplementary activities:

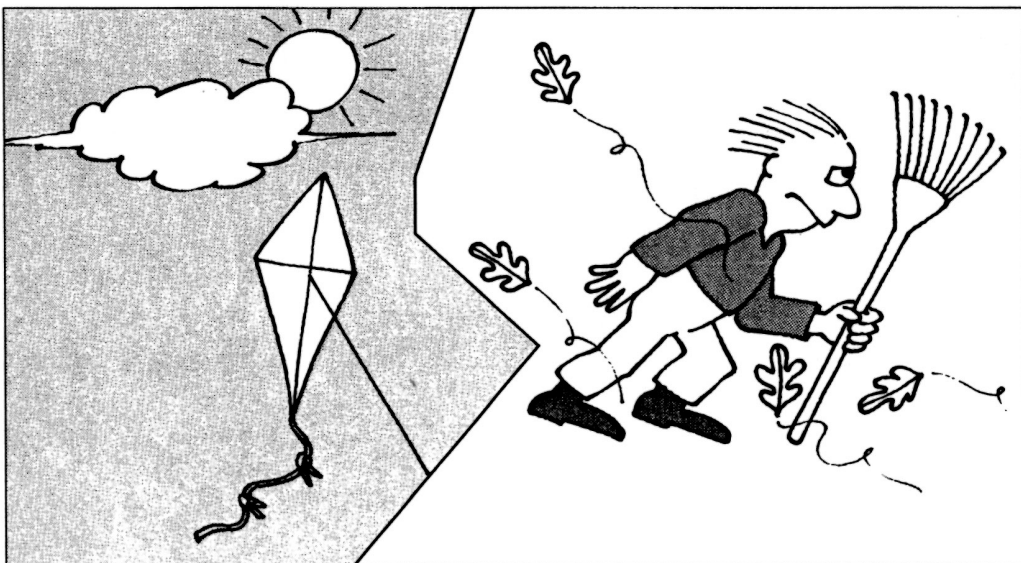
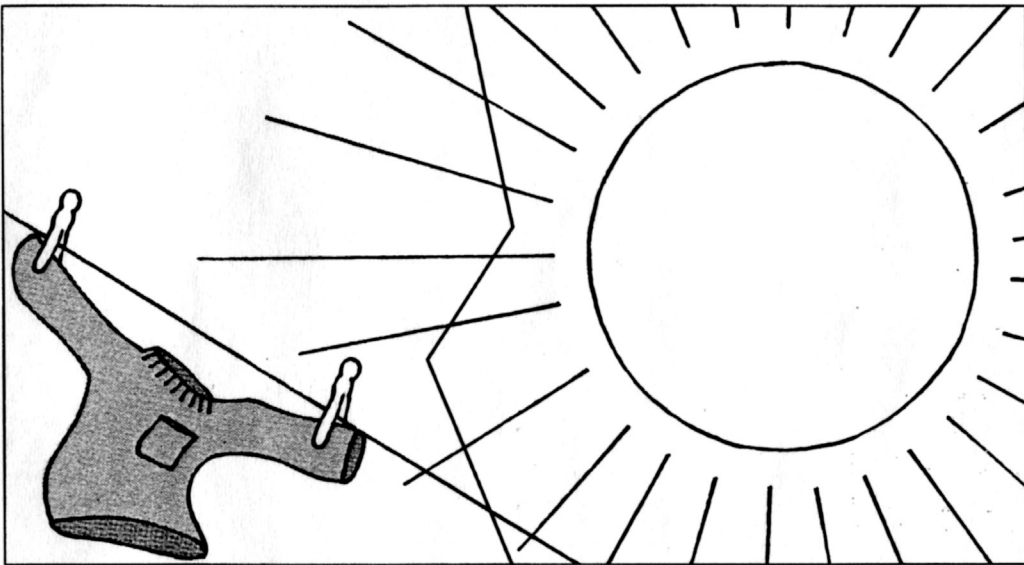
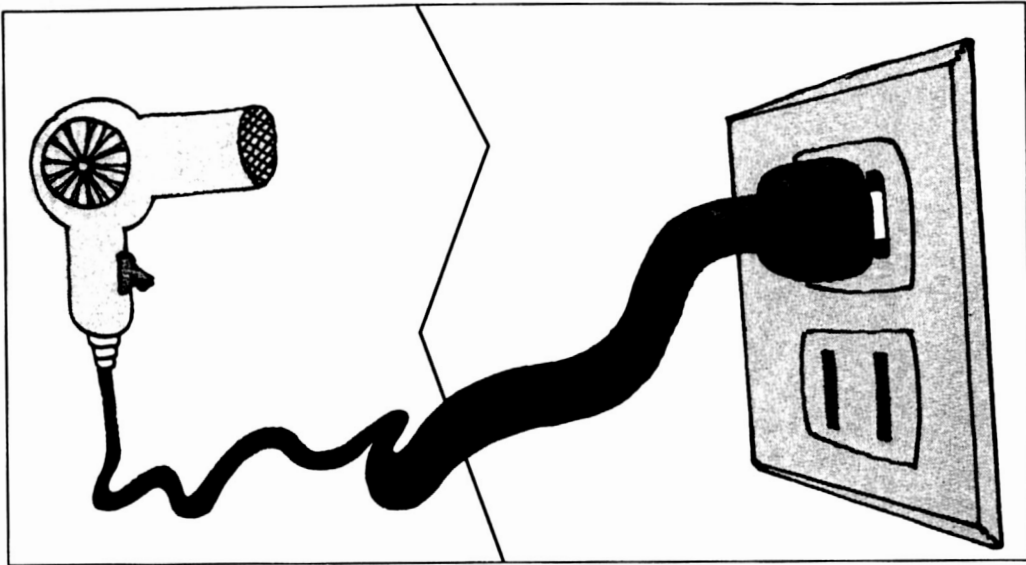
- A. Block** –Make small gas tanks from toilet paper rolls or milk jugs to use with cars and trucks during self-selected activity time.
- B. Group** – Read the electric and water meters at the school. Chart the usage each month.
- C. Music** –Sing “Row, Row, Row Your Boat” and discuss the type of energy needed to row a boat.
- D. Outside** –Make gas tanks, with hose attached, from large cardboard boxes. Place them outside for use with tricycles.
- E. Science** – Bring in a selection of wind-up toys and discuss where they get their energy.

## Children’s Literature

Taken from the special children’s literature section in *Conservation Seeds* is this listing of energy related books appropriate for the classroom:

- Berger, Melvin. *All About Electricity*. New York: Scholastic, Inc., 1995
- . *Switch On, Switch Off*. New York: HarperCollins, 1990.
- DeRegniers, Beatrice Schenk. *Who Likes the Sun?* New York: Harcourt Brace, 1961.
- Gibbons, Gail. *Sun Up, Sun Down*. New York: Harcourt Brace, 1983.
- Lionni, Leo. *Alexander and the Wind-Up Mouse*. New York: Knopf, 1987.
- Pondendorf, Illa. *The True Book of Energy*. Chicago: Children’s Press, 1963.

**Teachers please note:** *Conservation Seeds* includes four additional energy lessons in the winter section– Lesson 21, page 120; Lesson 22, page 122; Lesson 24, page 126 and Lesson 27, page 132.



# Name That Energy Source

## Objectives:

After completing this activity, students should be able to:

1. Define renewable and non-renewable energy sources. [2.3, 4.1, CA1, CA6, SC1]
2. Research and describe a particular energy source. [1.2, 1.4, 1.9, 3.8, 4.6, CA1, CA3, SC1]
3. Create a group presentation. [1.5, 2.1, 1.6, CA1, CA5, SC1]

## Materials:

Research materials on renewable and non-renewable energy sources

## Background:

1. Have students form groups of 3-4.
2. Ask each group to develop their own generic definition for the following words: **energy**, **resource**, **renewable**, **alternative**.

3. Have one member from each group write their group definitions on the chalkboard under the appropriate headings.

4. Discuss all definitions as generic words and then steer the discussion toward energy, renewable and non-renewable resources, and alternative energy sources.

**Energy:** the ability or capacity to do work.

**Resource:** means of support; materials found in the environment that can be extracted for human use.

**Renewable:** able to restore; renewable energy is energy from sources that cannot be used up: sunshine, water flow, wind and vegetation and geothermal energy, as well as some combustible materials, such as landfill gas, biomass, and municipal solid waste.

**Non-renewable:** unable to restore, non-renewable energy is from sources that can be used up: fossil fuels (including coal, crude oil, natural gas)

**Alternative:** An additional option; alternative energy sources are renewable energy sources as opposed to the non-renewable resources commonly used today.

**Fossil fuels:** fuels formed eons ago from decayed plants and animals. Oil, coal and natural gas are such fuels.

**Nuclear energy:** the energy trapped inside an atom; nuclear reactors use radioactive uranium to perform fusion of two atoms; this is the same reaction that the sun uses to provide solar energy

5. In their groups, have students sort the energy sources on the copy page into renewable, non-renewable, or nuclear energy sources. Ask students where they think your community's electricity comes from?

## Procedure

1. Have each group research the origin, use, and future of one of the following resources: Fossil fuels, nuclear, hydro-electric, solar, wind. Students should:

- a.Explain the history of the resource. How long has it

been used? Is it commonly used today?

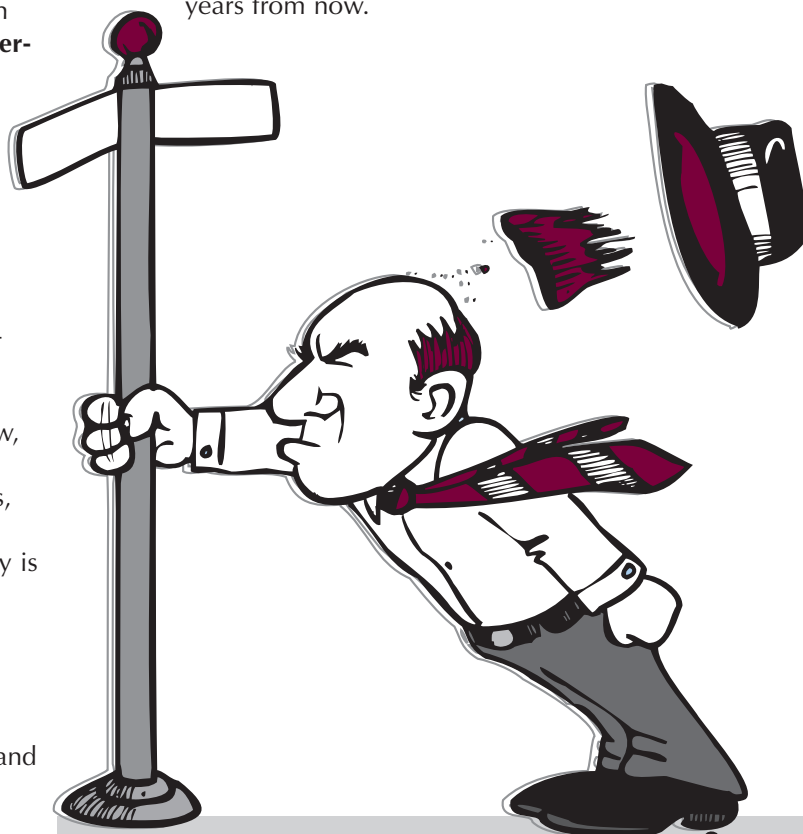
b.Trace the origin of your energy source back to its original source (e.g., A wood stove uses wood as its energy source. Wood comes from trees. Trees use the sun to make food. Therefore, the original energy source for a wood stove is the sun!)

c.Identify some positive and negative aspects of your energy source.

2. Have groups present their results to the class. Groups should come up with a visual aid for their presentation (poster, skit, commercial, power point,etc.).

## Extension:

Have students write an essay on the following topic: Predict what energy sources will be prevalent one hundred years from now.

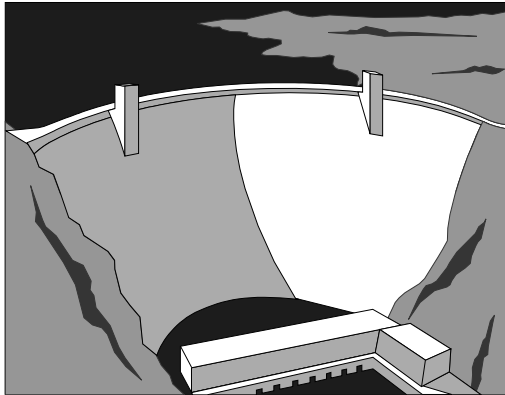
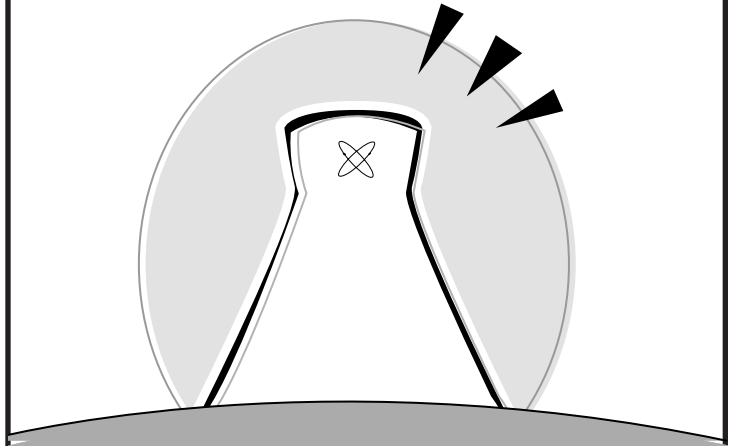
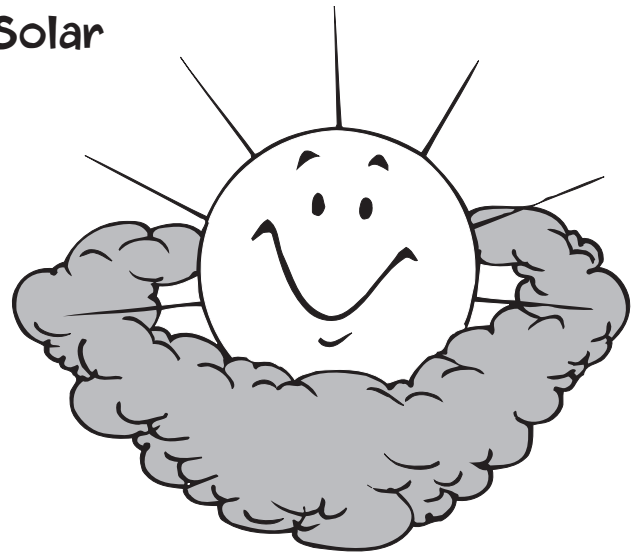
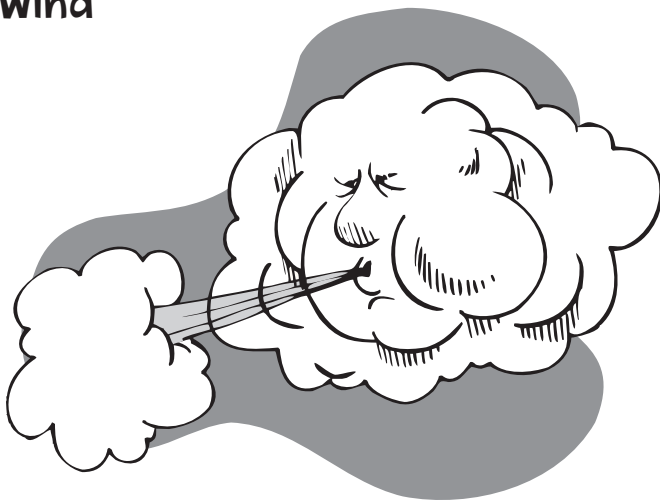
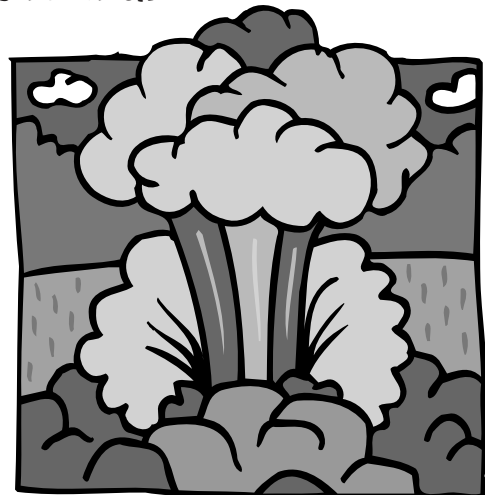


**OUTSIDEin** is a student level insert to the Department

of Conservation's official monthly publication *Missouri Conservationist*. After reading "Writing with Lewis and Clark" taken from **OUTSIDEin** in the November issue of *Missouri Conservationist*, have students research and read additional excerpts from the journals of Lewis and Clark. Students can then compare the energy resource available at that time to the present time and what might be in the future.

**OUTSIDEin**  
Guide

5-8

**Hydroelectric****Nuclear****Fossil Fuels**  
(coal, crude oil, natural gas)**Solar****Wind****Geothermal**

# What a Bike!

## Objectives:

After completing this activity, students will be able to:

1. Evaluate the modes of transportation that students take to school. [1.2, 3.8, CA1, CA6, MA1, SC1, SC8]
2. Calculate the static efficiency of a bicycle. [1.2, 1.6, 1.8, 3.5, CA4, MA1, MA2, SC1, SC2, SC8]

## Materials:

Bicycle, bathroom spring scale, masking tape, meter stick

## Procedure:

### Part A.

1. Have students take a poll to determine how each student got to school this morning.
  - a. I drove to school with no passengers.
  - b. I drove or rode in a vehicle with one or more passengers.
  - c. I took a bus.
  - d. I rode a bicycle.
  - e. I walked.
2. Discuss the benefits and consequences of each transportation method. Why are some methods more common than others?
3. Which is the most convenient? Which is the most energy efficient? What factors might persuade you to ride a bicycle, bus, or walk to school? Encourage students to develop

a school-wide action plan that would promote energy conservative methods of transportation.

9-12

### Part B.

Use the student handout to direct students in determining the efficiency of a bicycle.

## Background

Bicycles were invented in the early 1800s and have had the same basic form for the past century. Although you may be most familiar with the bicycle as a form of recreation, many people around the world use them as their primary means of transportation.

Bicycles are the most efficient form of transportation. It takes less energy to move a kilogram of body mass over a distance of one kilometer by using a bicycle than any other transportation method!

Bicycles run on human energy, rather than gasoline or electricity. Therefore, no pollution is created when riding a bicycle. As with all sources of energy, the original source of power for a bike is the sun! The sun's energy is transformed into plant material through photosynthesis; other animals (and cyclists) eat these plants; a cyclist metabolizes this food energy and transforms it into mechanical energy through a bicycle! Bike riding is a good form of exercise and can be beneficial to your health.

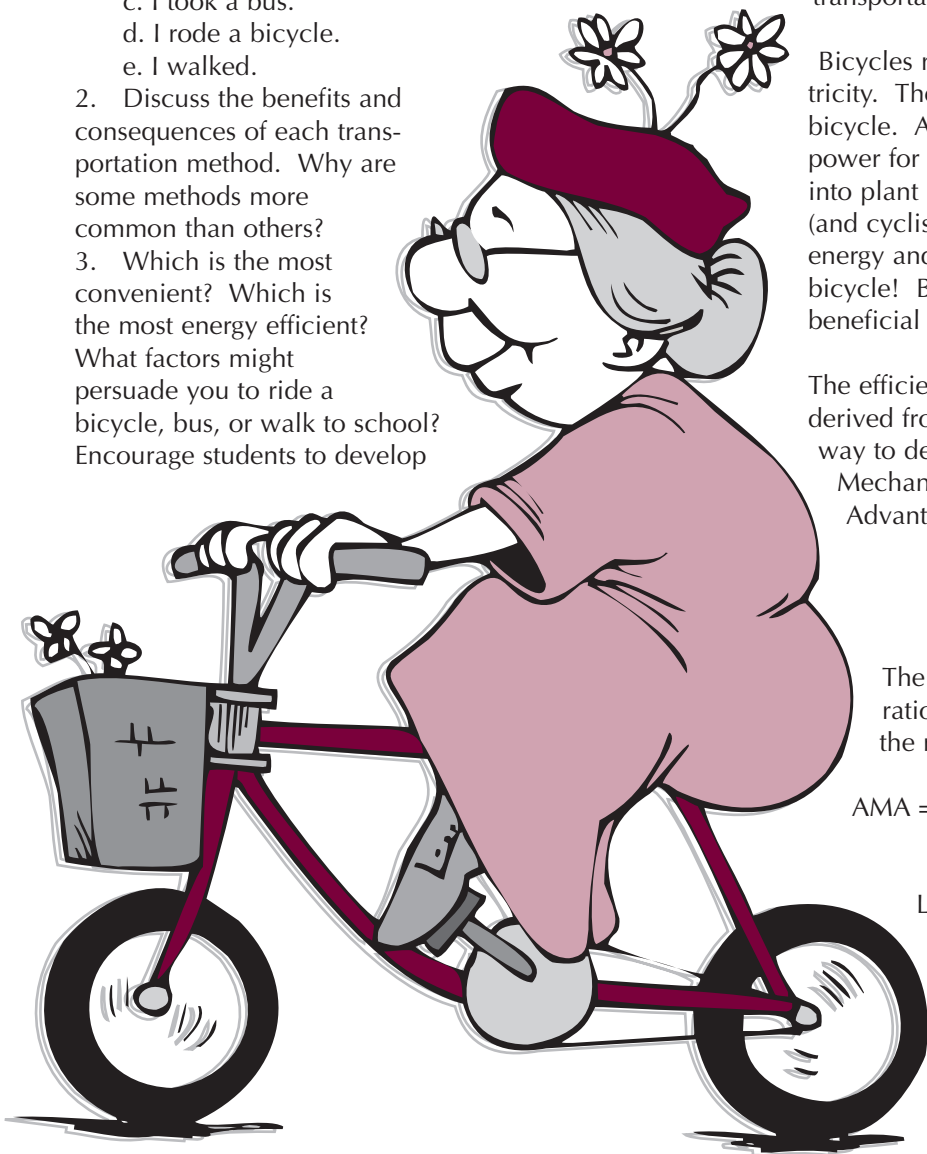
The efficiency of a machine is the ratio of the useful work derived from the machine to the energy put into it. Another way to define efficiency is as the ratio of the Actual Mechanical Advantage (AMA) to its Ideal Mechanical Advantage (IMA).

$$\text{Efficiency} = \frac{\text{AMA}}{\text{IMA}}$$

The AMA of a bicycle can be found by taking the ratio of the Force Output to Force Input. The IMA is the ratio of the Input Distance to Output Distance.

$$\text{AMA} = \frac{\text{Output Force}}{\text{Input Force}} \quad \text{IMA} = \frac{\text{Input Distance}}{\text{Output Distance}}$$

Let's use these formulas to calculate the efficiency of a bicycle.



# Determining Bicycle Efficiency

Bicycles are the most efficient form of transportation. Using the formulas below, calculate just how efficient they are.

## Procedure:

1. The Input Force for a bicycle is the weight of the cyclist. Chose a person as the "cyclist" and measure his/her weight using a bathroom spring scale. If the scale is in pounds, convert the number into kilograms ( $1 \text{ kg} = 0.453592 \text{ pounds}$ ). Record this number on Line A.
2. To find the Output Force, have someone hold the scale against a wall at the height where the bicycle wheel will hit it squarely. Have the chosen "cyclist" back the bicycle slightly away from the wall so that the pedals of the bicycle are in a horizontal position. The cyclist should then press down on the front pedal so that the bicycle bumps into the scale. Do this while standing and try to have your entire weight on the pedal. Record the force applied to the scale in kilograms on Line B.
3. The Input Distance for the bicycle is the circumference of the pedal rotation. Find this by measuring the radius ( $r$ ) of the pedal rotation (the distance from one pedal to the central axis). Calculate circumference by using the formula:  $C = 2(\pi)r$ . Record your answer on Line C in meters). (PROVIDE DIAGRAM)
4. The Output Distance is the distance the bicycle moves in one pedal rotation. Move the bicycle to an open space. Mark the front wheel's original position on the floor with masking tape. Using your hand, take the pedal and move it through one complete revolution. Mark the new front wheel position on the floor with masking tape. Measure the distance between these two points in meters and record on Line D.
5. Calculate the Actual Mechanical Advantage on Line E.
6. Calculate the Ideal Mechanical Advantage on Line F.
7. Calculate the bicycle's Efficiency on Line G.
8. Optional: Repeat with the bicycle in different gears. Is there any difference in the efficiency of high and low gears? Why do you think this might be?

## Questions:

1. Studies of bicycles in wind tunnels have shown efficiencies of 80% or greater. Why might your efficiency results be lower than this? What human or experimental errors may have affected your results?
2. When actually riding a bicycle, what other factors affect the bicycle's true efficiency?
3. Discuss three benefits of riding a bicycle. Within your answer, explain the importance of conserving energy.

## Final Thought:

On the energy of 350 calories (the amount found in one apple tart or a large slice of pizza):

- A cyclist can travel 10 miles
- A pedestrian can travel 3.5 miles
- An automobile can move 100 feet!

Think of times when you could ride a bike instead of driving – it pays to conserve energy!

## Data Sheet:

- D. Weight of cyclist = Input Force = \_\_\_\_\_ kg  
 E. Force of bike against wall = Output Force = \_\_\_\_\_ kg  
 F. Circumference of pedal rotation =  
     Input Distance = \_\_\_\_\_ m  
 G. Distance bike moves in one pedal rotation = Output  
     Distance = \_\_\_\_\_ m  
 H. Actual Mechanical Advantage =  
     Output Force = \_\_\_\_\_ kg = \_\_\_\_\_  
     Input Force                      kg  
 I. Ideal Mechanical Advantage =  
     Input Distance = \_\_\_\_\_ m = \_\_\_\_\_  
     Output Distance                      m  
 J. Static Efficiency =  $\frac{\text{AMA}}{\text{IMA}}$  = \_\_\_\_\_



# Teacher resources

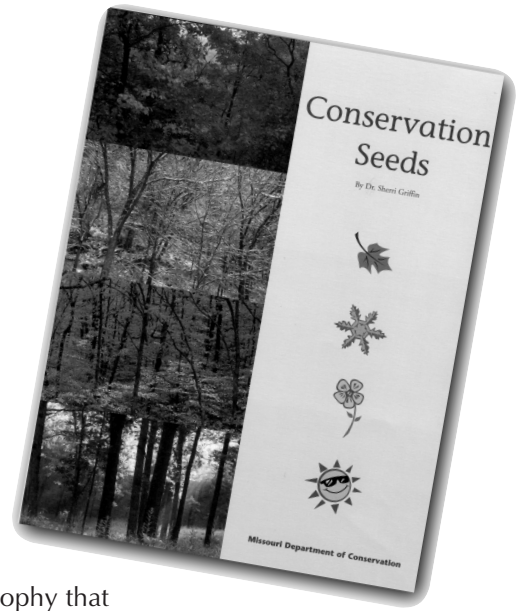
## Two new offerings from the Department of Conservation *Conservation Seeds*

Developing good habits at an early age—it's the thing to do.

The Missouri Department of Conservation wants to do just that with its early childhood curriculum *Conservation Seeds*. Resources are at your fingertips to help the minds of young children become aware of nature and conservation.

In keeping with educational advancements, the Department of Conservation has revised the original 1983 version of *Conservation Seeds* for release in September 2001. This hands-on book of activities for three-

through seven-year olds, clearly follows the philosophy that everyone learns best by doing. The curriculum is organized with seasonal themes to make it user-friendly. Each topic is supplemented with activities to expand on the learning event. In addition, a special section designated by topic lists children's literature appropriate for the classroom.



## Missouri WETLANDS & Waterfowl Poster

A new dramatic full-color poster from the Department of Conservation vividly displays Missouri's wetlands and waterfowl. Experience a fall hunting expedition as you enjoy this dramatic piece of art. The reverse side offers waterfowl and wetland wildlife identification as well as numerous activity ideas.

To receive a copy of this publication or poster write to:  
Distribution Center, Missouri Department of Conservation,  
PO Box 180, Jefferson City, MO 65102

## Recruiting Grades 4 - 9 Science Teachers

Middle level teachers interested in environmental issues are being recruited for participation in ENVISION. The program, funded by the National Science Foundation and held at Purdue University, will train leadership teams through active research while focusing on environmental issues, standards-based curriculum building and partnership building. Leadership teams must consist of two participants; one requiring more time commitment than the other. Module descriptions for the institute include:

- Water and Watersheds - emphasis is on environmental science concepts and issues surrounding water, streams and wetlands.
- Urban and Built Environments - environmental concepts and issues related to buildings, cities and suburbs are investigated.
- Rural Environments - the effects of human activities and agricultural practices on rural environments are explored.

Dates for the institute are: Spring Pre-institute -April 25 - 27 Summer Institute - July 8 - 30

Application Deadline is February 15

For further information check the web site <<http://www.eas.purdue.edu/geomorph/envision>> or email at [envision@purdue.edu](mailto:envision@purdue.edu) or send your name and address to ENVISION 1441 LAEB Dept. of Curriculum & Instruction, Purdue University West Lafayette, IN 47907-1442 Phone 765-494-0803